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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/803,059	03/18/2004	Etienne Quesnel	119144	4621

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EXAMINER	
CHANG, AUDREY Y	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 05/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/803,059	QUESNEL, ETIENNE	
	Examiner	Art Unit	
	Audrey Y. Chang	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-8,11 and 12* is/are rejected.

7)☒ Claim(s) *2,3,9 and 10* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 March 2004* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/18/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's preliminary amendment filed on March 18, 2004, which has been entered into the file.
- By this amendment, the applicant has amended claim 6 and has newly added claims 9-12.
- Claims 1-12 remain pending in this application.

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the features concerning the multiplayer structure of the alternate superposed first and second layers as recited in claim 1 and the intermediate metal layer and two peripheral layers for the first layer as recited in claims 2-3 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be

notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. **Claims 2-3, and 9-10 are objected to because of the following informalities:**

(1). The phrase "two peripheral layers" recited in claims 2-3 is confusing and indefinite since it is not clear if the term "periphery" means *adjacent* layers as the *top* and *bottom* layers of the intermediate metal layer or the layers arranged at *periphery* (i.e. at *border*) of *the intermediate* metal layer. The phrase "the two peripheral layers" recited in claim 3 is confusing and indefinite since it lacks proper antecedent basis from its based claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 4, 6-8, and 11-12 rejected under 35 U.S.C. 103(a) as being unpatentable over US patent application publication by Hoshino (US 2002/0014403) in view of the article by Kortright et al (Applied Optics Vol. 27 No. 14, Pages 2841-2846).

Hoshino teaches a *multilayer* reflector (11) as an *extreme ultraviolet radiation* (EUV) *reflector* that is comprised of 40 *paired* layers of molybdenum (Mo) layer, serves as the *first metal* layer, and *amorphous silicon* film (a-Si), serves as the *second* layer wherein the cycle length of a *pair of the* Mo and a-Si layers is set to be 6.9 nm, (please see paragraph [0066]). Hoshino teaches that the EUV reflector can

be used as *reflective mask* for *EUV lithography,* (with regard to claims 6, 11-12), typically in the wavelength range between 3 and 30 nm, (please see paragraphs [0002], [0004] and [0005]).

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the amorphous silicon layer is comprised of the claimed amorphous silicon compositions or compounds. **Kortright** et al in the same field of endeavor teaches that *amorphous silicon carbide* (a-SiC) is a suitable layer coating material for extreme ultraviolet optics. Kortright et al teaches explicitly about the refractive index of the amorphous silicon carbide (a-SiC) at different wavelength ranges, including the extreme ultraviolet wavelength, (please see Table 1), which is essential factor for designing the multilayer reflector. It would then have been obvious to one skilled in the art to apply the teachings of Kortright et al to modify the EUV reflector of Hoshino by using amorphous silicon carbide as the alternative layer material to make the EUV reflector or the reflective mask with desired optical properties. Although the Kortright et al does not teach explicitly about the carbon content of the amorphous silicon carbide is between 0.01 to 0.3, such modification is considered to be obvious to one skilled in the art since by changing the dope content the refractive index and other material properties of the amorphous silicon carbide material will also be changed and such change has the benefit of making the multilayer reflector with more desired optical properties for the particular needs for particular application.

With regard to claim 7, Hoshino teaches that the cycle length or thickness of the paired metal molybdenum layer and the amorphous silicon layer is 6.9 nm, (please see paragraph [0066]).

With regard to claim 8, Hoshino teaches that the multilayer reflector comprises 40 pairs of the metal layer and the amorphous silicon layer this means there are 40 layer of the molybdenum layer.

5. Claims 1, 4, 6-8, and 11-12 rejected under 35 U.S.C. 103(a) as being unpatentable over US patent issued to Burger et al (PN. 6,869,676) in view of the US patent application publication by Hoshino (US 2002/0014403).

Burger et al teaches a multilayer structure that is comprised of a an alternatively arrange first layer and second layer wherein the first layer comprises metal or metal carbide material wherein the second layer comprises amorphous silicon containing hydrogen, (i.e. a-Si-H), (please see column 3, line 20 to column 4, line 14).

This reference has met all the limitations of the claims with the exception that Burger et al does not teach explicitly that the multilayer structure is capable of reflecting extreme ultraviolet wavelength range of (10 nm to 20 nm). **Hoshino** in the same field of endeavor teaches a *multilayer* reflector (11) which is an *extreme ultraviolet radiation* (EUV) *reflector* that is comprised of 40 *paired* layers of molybdenum (Mo) layer, serves as the *first metal* layer, and *amorphous silicon* film (a-Si), serves as the *second* layer. With regard to claims 6-8 and 11-12, Hoshino further teaches that the multilayer reflector has a cycle length of 6.9 nm for the *pair of the* Mo and a-Si layers (please see paragraph [0066]) and the EUV reflector can be used as *reflective mask* for *EUV lithography,* (with regard to claims 6, 11-12), typically in the wavelength range between 3 and 30 nm, (please see paragraphs [0002], [0004] and [0005]). It would then have been obvious to one skilled in the art to apply the teachings of **Hoshino** in combination with the teachings of **Burger** et al to modify the multilayer structure of Burger to form a EUV multilayer reflector for the benefit of making the multilayer structure suitable as a reflective mask for the EUV lithography.

These references also do not teach explicitly about the hydrogen content of the amorphous silicon containing hydrogen to be between 0.01 to 0.3, such modification however is considered to be obvious to one skilled in the art since by changing the dope content the refractive index and other material properties of the amorphous silicon containing hydrogen material will also be changed and such change has the benefit of making the multilayer reflector with more desired optical properties for the particular needs for particular application.

With regard to claim 4, Hoshino teaches that molybdenum is a suitable metal layer for making the EUV reflector. It would then have been obvious to one skilled in the art to use known and suitable material in the art to make the multilayer reflector for the EUV mask for the benefit of making a EUV reflector with good reflective property.

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over US patent application publication by Hoshino (US 2002/0014403) and the article by Kortright et al (Applied Optics Vol. 27 No. 14, Pages 2841-2846) as applied to claim 1 above, and further in view of the patent issued to Montcalm et al (PN. 5,958,605).

The multilayer EUV reflector taught by **Hoshino** in combination with the teachings of **Kortright** et al set forth in claim 1 above have met all the limitations of the claims. Hoshino teaches that the metal layer of the multilayer reflector comprises of molybdenum (Mo) but it does not teach explicitly that it may also be made of molybdenum carbide. **Montcalm** et al in the same filed of endeavor teaches a EUV multilayer reflector wherein the suitable metal layer materials comprise molybdenum or molybdenum carbide, (please see column 2, lines 1-9). It would then have been obvious to one skilled in the art to apply the teachings of **Montcalm** et al to use molybdenum carbide as an alternative metal layer material to make an EUV reflector for the benefit of using well-known and suitable material in the art to make the EUV reflector with desired reflectivity and optical characteristics.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over US patent issued to Burger et al (PN. 6,869,676) and US patent application publication by Hoshino (US 2002/0014403) as applied to claim 1 above, and further in view of the patent issued to Montcalm et al (PN. 5,958,605).

The multilayer structure taught by **Burger** et al in combination with the multilayer EUV reflector taught by **Hoshino** as set forth in claim 1 above have met all the limitations of the claims. Burger et al teaches that the metal layer may also comprise metal carbide layer, (please see column 3, lines 61-67). Hoshino teaches that the metal layer of the multilayer EUV reflector comprises of molybdenum (Mo) but these references do not teach explicitly that the metal layer is comprised of molybdenum carbide. **Montcalm** et al in the same filed of endeavor teaches a EUV multilayer reflector wherein the suitable metal layer materials comprise molybdenum or molybdenum carbide, (please see column 2, lines 1-9). It would then have been obvious to one skilled in the art to apply the teachings of **Montcalm** et al to use molybdenum carbide as an alternative metal layer material to make an EUV reflector for the benefit of using well-known and suitable material in the art to make the EUV reflector with desired reflectivity and optical characteristics.

Allowable Subject Matter

8. The following is a statement of reasons for the indication of allowable subject matter: of the prior art references considered none has disclosed an optical device for reflecting a range wavelength in 10 nm to 20 nm and comprises alternative pair of metal layer and amorphous silicon layer selected from the amorphous compounds with the specific content, explicitly stated in claim 1, wherein the metal layer is further comprised of an intermediate metal layer and two *adjacent* layers, interposing the intermediate metal layer, formed of carbide of said metal, nitride of said metal, boron carbide or carbon as set forth in claim 3.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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